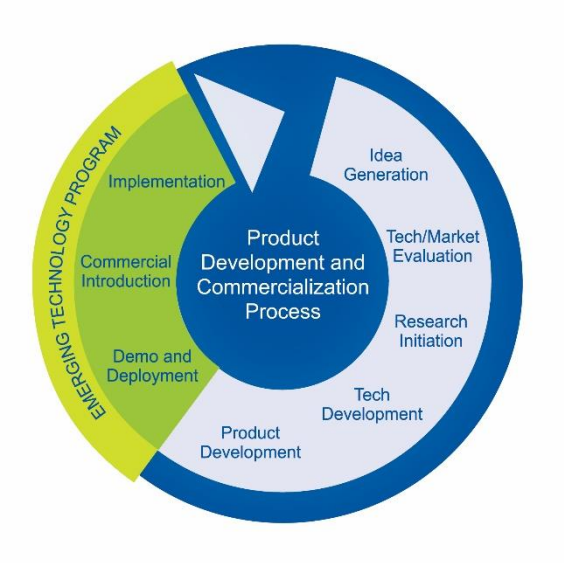

CEC Webinar

Emerging Technologies: Innovative Water Heating Approaches

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Company Overview

- Independent, not-for-profit R&D organization with extensive laboratories
- GTI tackles tough energy challenges turning raw technology into practical solutions
- Downhole to the burner tip including energy conversion technologies

360+ EMPLOYEES

RESEARCH & DEVELOPMENT

PROGRAM MANAGEMENT

TECHNICAL/ ANALYTICAL

CONSULTING

TRAINING

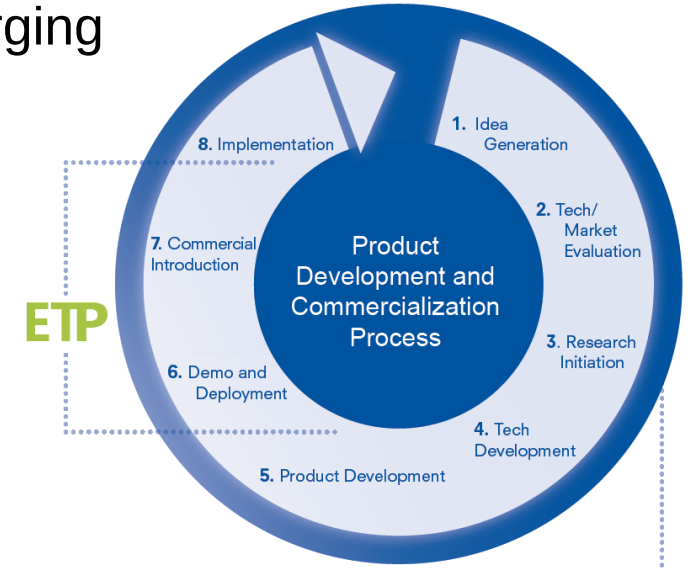
Energy Efficiency Program Collaboration
Emerging Technology Program

ETP Emerging Technology Program

> Gas Technology Institute led, utility supported, **North American collaborative** targeting **residential, commercial,** and **industrial** solutions

> ETP's principle goal is to **accelerate** the **market acceptance** of emerging energy efficient technologies

Alagasco
DTE Energy
neea
Pacific Gas and Electric Company
Ameren Focused Energy. For life.
ENBRIDGE
New Jersey Natural Gas
PUGET SOUND ENERGY
SOUTHWEST GAS
Research Foundation
EnergyTrust of Oregon
Nicor Gas An AGL Resources Company
QUESTAR Gas
spire
AVISTA
FORTIS BC
NW Natural
SDGE A Sempra Energy utility
TECO PEOPLES GAS
CASCADE NATURAL GAS In the Community to Serve
INTERMOUNTAIN GAS COMPANY
NYSEG
SoCalGas A Sempra Energy utility
uniongas A Spectra Energy Company
CenterPoint Energy
National Fuel
Oklahoma Natural Gas A Division of ONE Gas



ETP activities are "beyond development" stage: Field Testing, Demonstration, Pilot Programs, and Deployment – a focused effort to ensure market acceptance of next-generation emerging technologies

gti

Rheem H2AC™ Integrated Air & Water System

- **Technology:** The Rheem H2AC™ Rooftop Unit (RTU) takes the heat removed from an air conditioned space—which is typically exhausted—and transfers it to a water heater storage tank.
  - When cooling is required, it will recover the waste heat, and preheat hot water to as high as 125°F.
  - Waste heat recovery components are factory installed in the RTU, and leak checked. Minimizes installation error.

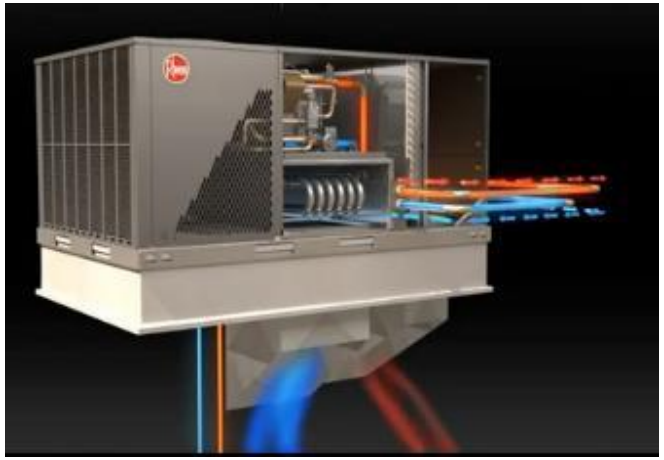


Photo provided by Rheem

- **Proven Through Third Party M&V**
  - 3 GTI ETP project demonstrations complete.
  - 3 SoCal Gas technology assessments complete.
  - *Ongoing*: A CEC sponsored project to demonstrate technology for an industrial application.
- **Best Applications**
  - Cooling-Dominated Climates (1,500 CDD+ year).
  - Target sites use the 15-ton system, and 1,500+ gallons hot water per day
    - Restaurants (4,700 ft2 or larger), food processing, health clubs, hotels, assisted living.

Rheem H2AC™ How it Works

A. Cold water enters the tank

B. Room thermostat calls for cooling

C. Based on water temperature, H2AC sends refrigerant to the heat exchanger.

D. Outdoor fans stop

E. Pumps circulate water from tank

F. Temperature rises in tank, and waste heat is stored

G. Pre-heated water enters water heater from tank

H. Hot water is used at fixtures

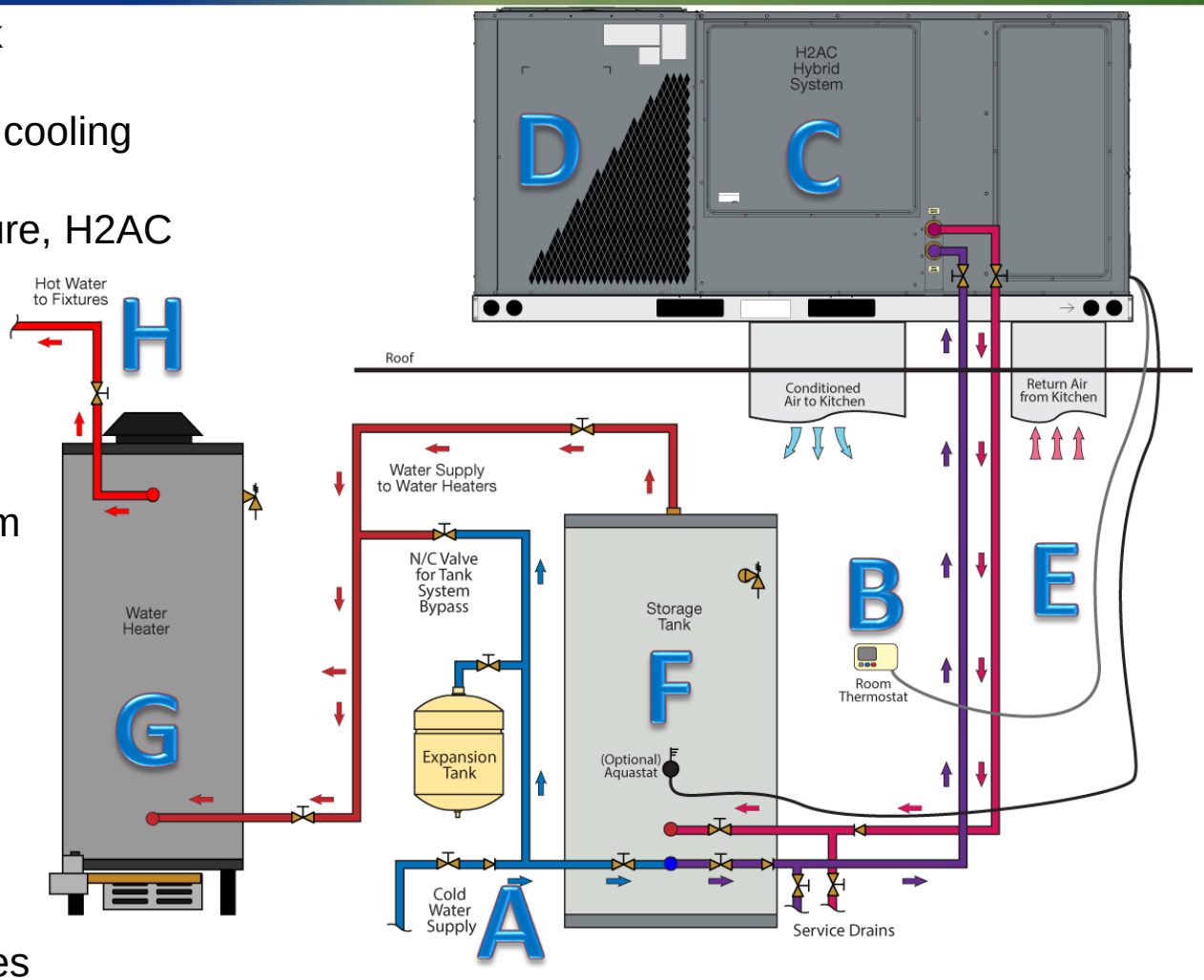


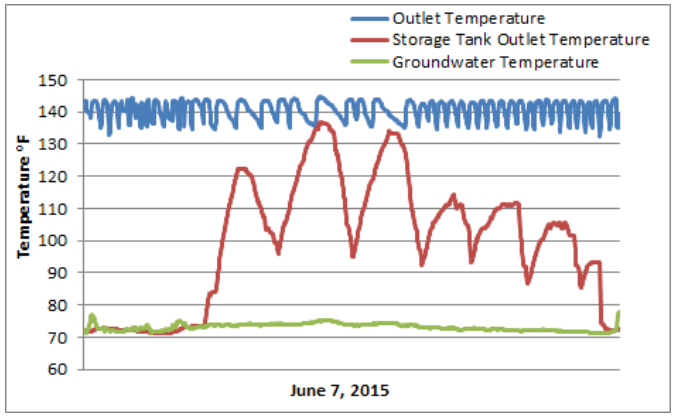
Photo source: Rheem

ETP Field Demos

Alagasco Territory	APGA RF Territory	SDG&E Territory
Full-Service Restaurant National Chain #1	Full-Service Restaurant National Chain #2	Full-Service Restaurant National Chain #3
10-Ton Unit	15-Ton Unit	10-Ton Unit
100 Gallons	119 Gallons	80 Gallons
H2AC Installed May ‘14	H2AC Installed Aug. ‘14	H2AC Installed Nov. ‘14
Monitoring Concluded	Monitoring Concluded	Monitoring Concluded
1400 Hot Water GPD	1750 Hot Water GPD	1300 Hot Water GPD
~35% hot water energy savings	~25% hot water energy savings	~30% hot water energy savings

Case Study:
Laguna Hills Host Site

- Restaurant that serves 475 meals per day
- 6,000 ft2
- 10 ton H2AC
- 80 Gallon Storage Tank
- Baseline water heater: storage tank
- Average Daily Water Usage: 1350 GPD
- 140°F Water Set Point
- Heat Transfer Fluid: Water



Rheem H2AC™ Equipment & Installation Costs

	15 ton system with 120 gallon storage tank	10 ton system with 120 gallon storage tank	Baseline 15 ton RTU	Baseline 10 ton RTU
H2AC RTU w/gas heating (material only)	$13,717	$11,913	$11,400	$7,900
Curb adapter (material only)	$1,100	$900	$1,100	$900
Rigging/placing/reconnecting power and gas*	$3,300	$2,800	$3,300	$2,800
Storage tank (material only)	$1,100	$1,100	$0	$0
Rigging/placing storage tank*	$500	$500	$0	$0
Water piping and accessories (material only)*	$2,000	$2,000	$0	$0
Plumbing labor*	$1,500	$1,500	$0	$0
Annual Maintenance Costs*	$600	$600	$600	$600
Estimated total	**$23,817**	**$21,313**	**$16,400**	**$12,200**

*These are estimates and should be used for discussion purposes only. Actual costs will vary by site and contractor.

Performance Conclusions

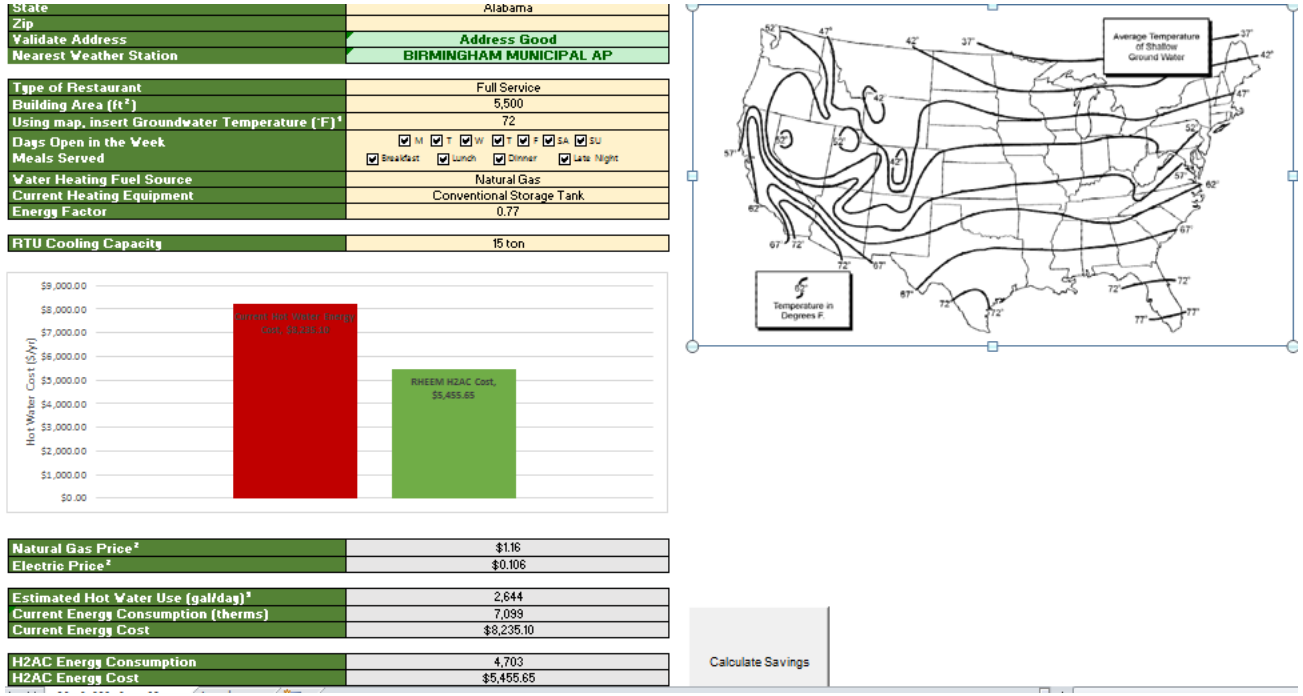
- Provided significant energy savings (25-35%).
- Simple paybacks ≤5 years under most scenarios.
- Both contractors and host sites would recommend the technology.
- Transition to programs:
  - GTI developed a performance model to estimate savings across many climates, hot water loads, and baseline water heater / RTU scenarios.

Energy Savings and Payback	Units	Tampa, FL 15 ton RTU	Birmingham, AL 15 ton RTU	Laguna Hills, CA 15 ton RTU	El Cajon, CA 15 ton RTU
Incremental Cost	$	$7,500	$7,500	$7,500	$7,500
Adjusted Annual Gas Savings	Therms	3,314	2,962	3,602	3,319
Annual Gas Savings ($1.00/therm)	$	$3,314	$2,962	$3,602	$3,319
Annual Gas Savings ($0.70/therm)	$	$2,320	$2,073	$2,521	$2,323
Simple Payback ($1.00/therm)	Years	2.3	2.6	2.1	2.3
Simple Payback ($0.70/therm)	Years	3.2	3.6	3.0	3.2

Figure 1: Rheem H2AC™ Energy Savings and Payback
Savings based on GTI calculator, developed with actual field results. Assumes 1,750 daily hot water use, .77 EF storage water heater, and 30 year average weather for each location. Table values should be used for discussion purposes only. Actual costs will vary by vendor, site, and contractor.

Rheem H2AC™ Performance Model

- Performance Model to estimate savings across many climates, hot water loads, and baseline water heater / RTU scenarios.
- Additional sites would make the model more robust.

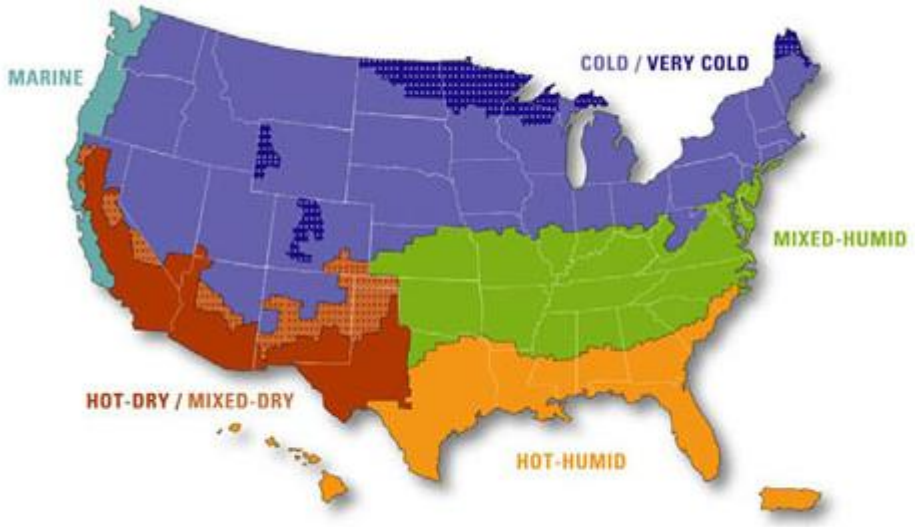


Performance Conclusions

- The systems provided significant energy and monetary savings. Simple paybacks ranged between 1.4 years and 8.8 years, but less than 5 years under most scenarios.

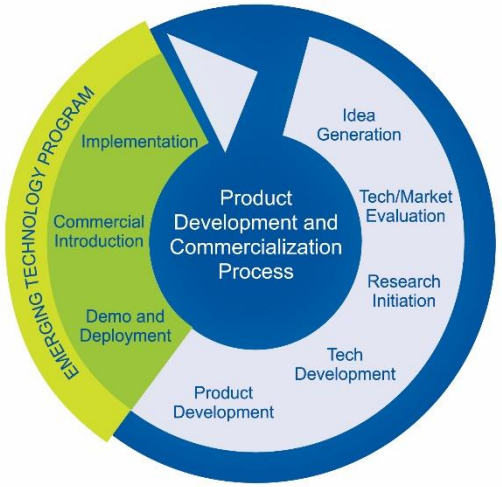
- The more hot water a site uses, the higher the savings.

- Temperature and relative humidity (climate) are the largest factors to influence savings. Note- Waste heat recovery is available only when mechanical cooling is enabled- *not during economizer operation*.



Source: Energy Information Administration

Thank you!



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